AIR FORCE PLANT PJKS, SYSTEMS INTEGRATION
LABORATORY, LONG-TERM OXIDIZER SILO
(Air Force Plant PJKS, Systems Integration
Laboratory, Building T-28B)
Waterton Canyon Road and Colorado Highway 121
Lakewood Vicinity
Jefferson County
Colorado

HAER No. CO-88-D

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
Rocky Mountain System Support Office
National Park Service
P.O. Box 25287
Denver, Colorado 80225-0287

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HISTORIC AMERICAN ENGINEERING RECORD

AIR FORCE PLANT PJKS, SYSTEMS INTEGRATION LABORATORY, LONG-TERM OXIDIZER SILO

(Air Force Plant PJKS, Systems Integration Laboratory, Building T-28B)

HAER No. CO-88-D

Location: Waterton Canyon Road and Colorado Highway 121, Lakewood Vicinity, Jefferson County, Colorado

Date of Construction: 1960-61

Fabricator: Kaiser Steel Corporation, Fabricating Division, Montebello, California

Present Owner: U.S. Air Force

Present Use: Deactivated, currently not in use

Significance: The Long-Term Oxidizer Silo played a significant role in the development of the Titan II ICBM, which not only served as the largest and most destructive weapon in the U.S. nuclear arsenal during the Cold War (1962-87) but also functioned as a launch vehicle for the Gemini space program in 1965. The structure was designed to assess long-term environmental impacts on storage of the missile's oxidizer (nitrogen tetroxide) as part of the Systems Integration Laboratory complex that contained facilities for testing, handling, and storage of the Titan II's hydrazine- and nitrogen tetroxide-based fuel system propellants. Testing and evaluation of the long-term environmental impacts on storage of the missile's propellant system oxidizer was critical to missile research and development and contributed to the success of the exceptionally significant Titan II program.

Historian: Harlan D. Unrau, National Park Service, Denver Service Center, 1999.

Description: Constructed in 1960-61 as part of the Systems Integration Laboratory complex, the Long-Term Oxidizer Silo (T-28B) was designed to evaluate long-term environmental impacts and effects on storage of the Titan II's propellant system oxidizer. The use of nitrogen tetroxide as an oxidizer was new, and little information regarding the long-term effects of its storage was available. This structure supported testing measures that subjected the oxidizer to an accelerated environmental cycle of heat and cold, simulating long-term environmental exposure. Thus, it measured the effects of long-term environmental change upon the stored propellant in an accelerated fashion.

During testing the oxidizer was stored in the silo for varying periods extending to more than one year, and the temperature of the oxidizer was maintained via temperature control devices. Test results indicated that when the oxidizer was placed in the

aluminum silo, it immediately reacted with the aluminum to form a passivation layer. Thereafter, there was no further reaction, thus demonstrating the viability of storing the oxidizer in Titan II propellant tanks for lengthy periods of time.

Located on a bench approximately 500' east of the Cold Flow Laboratory (T-6), this structure is attached to the north side of the Oxidizer Conditioning Structure (T-28D) approximately 100' south of the Systems Integration Laboratory Building (T-28). It was functionally linked to additional buildings in the Systems Integration Laboratory complex.

The Long-Term Oxidizer Silo structure, which was deactivated during the early to mid 1970s, consists of a silo structure 40'-0" in height and 20'-0" in diameter that rests on a 22'-0" x 22'-0" reinforced concrete foundation. The concrete pad, which is resistant to corrosive properties of the oxidizer, supported the filled oxidizer storage silo that had a total weight of approximately 175,000 pounds. The pad area was designed with a slope and curb that could divert an oxidizer spill of approximately 20,000 gallons to a disposal flume that would carry the spillage to the oxidizer waste tanks located downhill to the north-northwest. An oxidizer vapor exhaust stack was located to the north of the structure in the vicinity of the underground oxidizer storage facility.

The silo structure is enclosed with walls consisting of steel curtains that are manually operated and can be opened to allow for natural ventilation. Steel girders serve as the building's superstructure. The building has a gabled roof with a vent extending from its peak. Originally, metal duct conduits extended from the Oxidizer Conditioning Structure (T-27D) to the south side of the silo, and continued around its east and north sides. The ducts have been removed.

Two work platforms were originally located at 19'-0" and 33'-0" inside the enclosed silo structure. The platforms, accessed by a ladder, were designed so that they could be relocated at other elevations.

The deactivated Long-Term Oxidizer Silo has undergone little structural modification since its construction, and onsite examination found no evidence of significant structural alterations. However, use of this structure to support testing of later launch vehicle systems has resulted in upgrades and modifications to its technological systems and instrumentation.

History: The Long-Term Oxidizer Silo was constructed on Air Force property adjacent to the Martin Company's Denver Division plant during 1960-61. In May 1960, the Martin Company contracted with the Kaiser Steel Corporation, Fabricating Division, of Montebello, California, to prepare design specifications for and construct the silo structure as part of the Systems Integration Laboratory complex for Titan II propellant testing. The specifications and design drawings, based on design criteria developed by

Martin Company Cold Flow Laboratory personnel, were prepared by ARCAL, Engineers-Constructors of Pasadena, California, under a subcontract from Kaiser Steel. Initial construction operations began in late June or early July 1960. Construction was completed by early March 1961.

The facilities in the Long-Term Oxidizer Silo were utilized for testing and evaluation of long-term environmental impacts on storage of nitrogen tetroxide during the Titan II testing program from 1961 to 1964. Subsequently, the facility played a significant role in oxidizer storage testing for subsequent Titan launch vehicle systems until its deactivation during the 1970s.

Sources: Sources include architectural drawings, blueprints, and site plans in the Engineering Propulsion Laboratory and Plant Engineering and Construction Department at Lockheed Martin Astronautics. The corporation's Photographic Laboratory, Reproduction Services Department maintains an extensive collection of black and white and color photographs depicting construction, equipment, and testing activities at the silo structure as part of the Systems Integration Laboratory complex. Typescript copies of the contract and specifications for the structure may be found in the Archives of the corporation's Engineering Propulsion Laboratory.

Printed and/or published materials relating to the design and utilization of the structure include: "Criteria For the Design of XSM 68B Cold Flow Systems Test Laboratory and Components Test Laboratory, The Martin Company, Denver Division, Denver, Colorado, April 15, 1960," Compiled by Cold Flow Laboratory Facilities Group (copy in Archives, Engineering Propulsion Laboratory, Lockheed Martin Astronautics); "Part II Valuations for Appraisal of Government-owned Test Area, Sections 20, 21, 28, 29, T6S, R69W, 6th P.M., Jefferson County, Colorado for Martin Marietta Corporation by Blaine B. Chase, MAI, SRA, and Wilson W. Wampler, July 1, 1971 (copy in Plant Engineering and Construction Department, Lockheed Martin Astronautics); and U.S. Department of the Air Force, Air Force Materiel Command, Aeronautical Systems Center, Wright-Patterson Air Force Base, Ohio and U.S. Department of the Army, Fort Worth District, Corps of Engineers, Fort Worth, Texas, Historic Building Inventory and Evaluation, Air Force Plant PJKS, Jefferson County, Colorado, prepared by EARTH TECH, Colton, California, and William Manley Consulting, San Diego, California, February 1997.

Completion of the structure and laboratory complex is chronicled in "Main Area Profiles Change With Plant, Titan II Facilities," Martin Mercury 18 (10 March 1961): 2A, 2C; "First Titan II Propulsion System Test Firing at M-D," Martin Mercury 18 (16 June 1961): 2C; and "Titan II Passes Its First Captive Firing," M News 19 (12 January 1962): 1, 3.